compositions for the annual dues was also rejected. Dr. Allbutt Regius Professor of Physic, has been appointed an Elector to the Chair of Botany, in the place of the late Dr. Hort.

The discussion on the plans for the new Geological Museum (given at length in the *University Reporter* for December 13) was highly interesting, and appears on the whole to have been favourable to the scheme proposed, subject to relatively unimportant modifications. Prof. Newton objected that the arrangement of its contents should be zoological rather than stratigraphical; and the Registrary (Mr. J. W. Clark) took exception to the plan of lighting, which would be better if it were from the top rather than the sides. The geological staff were unanimous that the plan put forward was that which best met their needs. It was agreed that the architectural effect of the museum would be very fine, and worthy of Sedgwick's memory.

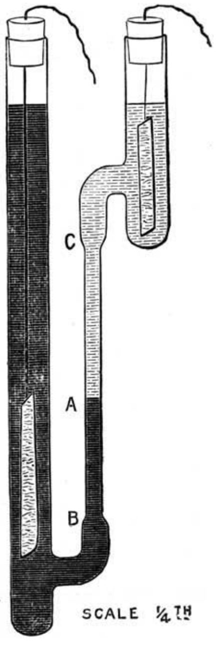
SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 24.—"Ionic Velocities." By W. C. Dampier Whetham, B.A., Fellow of Trinity College, Cambridge. Communicated by J. J. Thomson, F.R.S.

From a series of determinations of the electrolytic conductivity of various salt solutions combined with Hittorf's values for the migration constants, Kohlrausch calculated the velocity of different ions under a potential gradient of one volt per centimetre. Dr. O. Lodge actually observed the velocity of the hydrogen ion as it travelled along a tube filled with sodium chloride dissolved in jelly, decolourizing phenol-phthallein as it went. He found ·0029 cm. per sec., and Kohlrausch gives ·0030.

The author has measured the specific ionic velocity of other ions by observing the motions of a junction between two salt solutions of slightly different density and different colours, when a current was passed across it. From the velocity of the boundary, that of the ion causing the change in colour can be deduced. The apparatus consisted of two vertical glass tubes about 2 cms. in diameter, joined by a third considerably narrower, which was bent parallel to the others for the greater part of its length. The tube was filled with the solutions in such a manner that the boundary was formed in the vertical part of the junction tube.



When the solutions are of different specific resistances there will be a discontinuity of potential gradient at the boundary and a consequent electrification. The effect on the velocity of the boundary is, however, non-reversible, and, for small differences, can be eliminated by taking the mean of the velocities in opposite directions. The direct estimation of potential gradient is unsatisfactory, but by measuring the current (γ), the area of cross-section of the junction tube (A), the specific resistance of the solution (r), and the velocity of the boundary (v) we can find the specific ionic velocity v, for $v, = \frac{vA}{\gamma r}$.

The first solutions used were those of copper and ammonium chlorides dissolved in aqueous ammonia, the former being blue, the latter colourless. The junction travelled with the current with a velocity of 1·57 cm. per hour going upwards and of 1·60 cm. per hour coming downwards. The mean gives as the specific ionic vel. of Cu in solutions of ·1 gram. equiv. per litre ·000309 cm. per sec. This agrees exactly with Kohlrausch's number for infinitely weak solutions of ·00031 cm. per sec. Other measurements were made for chlorine and for the bichromate group (Cr_2O_7).

The method was extended to alcohol solutions. The velocities of both ions of a salt were determined by using two pairs of solutions. Thus the velocity of chlorine was found by using a cobalt chloride-cobalt nitrate pair, the colours of which are blue and red respectively, and that of cobalt by a cobalt chloride-calcium chloride pair, these being blue and colourless. The sum of these velocities was compared with that deduced by Kohlrausch's method from the conductivity of the solution. The following are the results:—

SPECIFIC IONIC VELOCITIES.

I.—*Aqueous Solutions.*

Ion	Velocity observed	Velocity calculated
Copper	0·00026* 0·000309	... ... 0·00031
Chlorine	0·00057* 0·00059*	... ... 0·00053
Bichromate group (Cr_2O_7)	0·00048 0·00047 0·00046	... ... 0·000473

* Preliminary observations.

II.—*Alcoholic Solutions.*

Salt	Vel. of Anion observed	Vel. of Kation observed	Sum of vels. observed	Sum of vels. calculated
Cobalt Chloride ...	0·000026	0·000022	0·000048	0·000060
Cobalt Nitrate ...	0·000035	0·000044	0·000079	0·000079

December 8.—"On the Velocity of Crookes' Cathode Stream." By Lord Kelvin, P.R.S.

In connection with his splendid discovery of the cathode stream (stream from the cathode in exhausted glass vessels subjected to electric force), Crookes found that when the whole of the stream, or a large part of the whole, is so directed as to fall on 2 or 3 sq. cm. of the containing vessel, this part of the glass becomes rapidly heated up to many degrees, as much as 200° or 300° sometimes, above the temperature of the surroundings.

Let v be the velocity, in centimetres per second, of the cathode stream, and ρ the quantity of matter of all the molecules in 1 c.c. of it. Supposing what Crookes' experiments seem to prove to be not far from the truth, that their impact on the glass is like that of inelastic bodies, and that it spends all their translational energy in heating the glass. The energy thus spent, per square centimetre of surface struck, per second of time, is $\frac{1}{2}\rho v^3$; of which the equivalent in gramme-water-centigrade thermal units is approximately $\frac{1}{2}\rho v^3/42,000,000$. The initial rate at which this will warm the glass, in degrees centigrade per second, is

$$\frac{\frac{1}{2}\rho v^3}{10^6 \times 42 . \sigma a} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; (1),$$

where σ denotes the specific heat of the glass, and a the thickness of it at the place where the stream strikes it.

The limiting temperature to which this will raise the glass is

$$\frac{1}{E} \times \frac{\frac{1}{2}\rho v^3}{42,000,000} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; (2)$$

where E denotes the sum of the emissivities of the two surfaces of the glass in the actual circumstances.

It is probable that ρ differs considerably from the average density of the residual air in the enclosure. Let us take, however, for a conceivably possible example, $\rho = 10^{-8}$, which is what the mean density of the enclosed air would be if the vessel were exhausted to 8×10^{-8} of the ordinary atmospheric density.

To complete the example, take

$$v = 100{,}000 \text{ cm. per sec.}$$

(being about twice the average velocity of the molecules of ordinary air at ordinary temperature); and take

$$\sigma a = \tfrac{1}{8} \text{ cm.},$$

as it might be for an ordinary glass vacuum bulb; and take

$$E = \tfrac{1}{3000},$$

which may not be very far from the truth.

With these assumptions, we find, by (1) and (2) approximately, 1° per second for the initial rise, and 375° for the final temperature, which are not very unlike the results found in some of Crookes' experiments.

The pressure of the cathode stream of the velocity and density which we have assumed by way of example is ρv^2, or 100 dynes per square centimetre, or about 100 milligrams heaviness per square centimetre, which is ample for Crookes' wonderful mechanical results.

The very moderate velocity of 1 kilom. per second which we have assumed is much too small to show itself by the optical colour test. The fact that this test has been applied, and that no indication of velocity of the luminous molecules has been found, has, therefore, no validity as an objection against Crookes' doctrine of the cathode stream.

Chemical Society, November 17.—Sir Henry Roscoe, Vice-President, in the Chair.—The Chairman congratulated the Fellows on the great improvement effected in the Society's rooms by the alterations carried out during the recess An address has been forwarded to the sister society in Berlin on the occasion of the celebration of its twenty-fifth anniversary. A resolution was passed at a meeting of the Council expressing deep regret that, through the death of Dr. Longstaff on September 23 last, the Society has lost its senior Fellow and one of its Founders. The following papers were read:—Fluosulphonic acid, by T. E. Thorpe and W. Kirman. This paper has been already reported in this volume, page 87.—Note on the interaction of iodine and potassium chlorate, by T. E. Thorpe and G. H. Perry. The reaction which occurs when iodine and potassium chlorate are heated together is usually represented by the equation $3KClO_3 + I_2 = KClO_4 + KCl + KIO_3 + ICl + O_2$; the authors find, however, that the main reaction consists in a simple interchange of iodine and chlorine thus—$2KClO_3 + I_2 = 2KIO_3 + Cl_2$.—The magnetic rotation of sulphuric and nitric acids, and of their aqueous solutions; also of solutions of sodium sulphate and lithium nitrate, by W. H. Perkin, sen. The author has previously shown that the molecular rotation of sulphuric acid is considerably influenced by the presence of water; the rotation rapidly falls for small dilutions, but diminishes as the amount of water is increased. The results are now extended; in the cases of sulphuric acid and sodium sulphate there is no apparent connection between the values representing the rotation and the extent to which dissociation is supposed to occur down to solutions containing 9 per cent. of acid or 12 per cent. of sodium sulphate. At a temperature of 90° the rotation is increased instead of diminished as indicated by the dissociation hypothesis. The results are not inconsistent with the assumption that the hydrate $(HO)_4SO$ is formed. In the case of nitric acid, the curve connecting rotation and percentage of acid is a straight line down to solutions containing 33 per cent. of HNO_3, and then apparently bends down somewhat; the results are not in agreement with the exigencies of the dissociation hypothesis. A compound of the composition $(HO)_3NO$ may be produced. Lithium nitrate resembles nitric acid in its behaviour. The rotations of strong aqueous solutions of the haloid hydrides change very rapidly with small dilutions, but more slowly with larger dilutions, becoming finally nearly stationary; such behaviour is not in accord with the dissociation hypothesis.—Note on the refractive indices and magnetic rotations of sulphuric acid solutions, by S. U. Pickering. Van der Willingen's results for the refractive indices of sulphuric acid solutions yield curves showing a well-marked "break" at 84·5 per cent. (H_2SO_4; H_2O), another "break" at 57·7 per cent. (H_2SO_4; $4H_2O$), and another at 24–30 per cent. The first two of these are also found on the magnetic rotation curves and all three of them agree with breaks found in the examination of other properties. The molecular volumes of solutions of the same strength as those used by Perkin when plotted out exhibit the same three breaks on the curve.—The hydrate theory of solutions. Some compounds of the alkylamines with water, by S. U. Pickering. The following table gives the compositions of a number of crystalline hydrates of fatty amines which the author has succeeded in isolating and analyzing:—

$EtNH_2,5H_2O$
$PrNH_2,5H_2O$
$Et_2NH,5H_2O$
$Pr_2NH,5H_2O$
Me_2NH,H_2O
$Et_3N,2H_2O$
$Me_3N,3H_2O$
$EtNH_2,5{\cdot}5H_2O$
$Bu^{\beta}NH_2,7H_2O$
$Me_2NH,7H_2O$
$Pr^{\beta}NH_2,8H_2O$
$PrNH_2,8H_2O$
$Et_2NH,8H_2O$
$Me_3N,11H_2O$

The freezing points of the hydrates ranged from + 5° to − 71°; indications of the existence of other hydrates were also obtained by "breaks" in the curves representing the freezing points of the solutions, and in every instance but one a hydrate of the composition thus indicated in the case of one amine was actually isolated in the crystalline condition in the case of some other amine. In connection with this subject Prof. Thorpe showed a very pretty experiment to illustrate the fact that whilst a mixture of triethylamine (15–50 per cent.) is clear and transparent at ordinary temperatures, the solution becomes turbid on warming, owing to the amine being thrown out of solution; on applying pressure to the warm liquid, however, re-solution occurs.—The atomic weight of boron, by E. Aston and W. Ramsay. The authors have investigated the atomic weight of boron; the atomic weight found from determinations of the water of crystallization of borax is 10 921 ± 0·01. The conversion of anhydrous sodium borate into sodium chloride by distilling it with hydrochloric acid and methyl alcohol and weighing the sodium chloride obtained gives an atomic weight of 10·966 for boron. The authors consider that Abrahall's number (10·825) for this constant is too low, as the boron bromide employed by him might have been contaminated with the compound BBr_3,HBr.—Methoxyamido-1 : 3-dimethylbenzene and some of its derivatives, by W. R. Hodgkinson and L. Limpach. An almost theoretical yield of 1 : 2 : 4-metaxylenol may be obtained by steam distilling a diazotized 5 per cent. solution of the corresponding xylidine sulphate. The product solidifies in a mixture of solid carbonic anhydride and ether. On nitration a theoretical yield of a mononitro-derivative ($NO_2 : OH = 1 : 2$) is obtained. A number of other compounds are described.—An extra meeting of the Society will be held on Tuesday, December 13, at 8 p.m., the anniversary of the death of Stas. A paper by Prof. J. W. Mallet, entitled "Jean Servais Stas, and the measurement of the relative masses of the atoms of the chemical elements" will be read and discussed.

Physical Society, Nov. 25.—Prof. S. P. Thompson, F.R.S., Vice-President, in the chair.—The following communication was made: Experiments in electric and magnetic fields, constant and varying, by Messrs. Rimington and Wythe Smith. In the first set of experiments shown exhausted electrodeless tubes and bulbs were rotated rapidly in a constant electric field between two parallel charged discs. Double fan-shaped images were produced by the tubes, due to the displacement currents which pass to equalize the potentials at the ends of the tubes. These fans were not symmetrical with respect to the lines of electric force, but were displaced in the direction of rotation. In explanation of this phenomenon it was pointed out that as a tube rotated the potential difference between its ends increased until this difference was sufficient to break down the dielectric in the tube. The discharges would therefore pass at the ends of the intervals during which the difference of potential was rising, and consequently the images would be displaced from the symmetrical position in the direction of rotation. The number of discharges produced during one revolution was found to depend on the strength of the electric field, but not on the speed of rotation, and that end of the tube which was approaching the negatively charged plate appeared brightest. These experiments were referred to as examples of the direct conversion of mechanical energy into light. Instead of rotating tubes in a constant electric field, the tubes were next kept stationary, and a varying electric field produced by connecting the plates with an influence machine allowed to spark; under these conditions the tubes and bulbs were seen to glow. Using large suspended plates charged by an induction coil, long tubes were caused to glow brightly even at considerable distances away from the plates. The glow could be apparently wiped out by passing the hand along the tube. Another series of experiments were performed in varying magnetic fields. With a view to showing Hertzian phenomena to large audiences the authors tried Geissler tubes to replace the spark-gap in resonators, with great success. When large Leyden jar circuits were used the effects were very brilliant. Another form of resonator consisted of a bent wire terminating in two plates, between which an exhausted tube was placed. This tube became luminous when the resonator was placed in the vicinity of a fairly large Hertz oscillator. Other experiments similar to those shown before the society at Cambridge by Prof. J. Thomson, on discharges in exhausted bulbs were then made, the bulbs being placed with a coil of wire of four turns, forming the connection between the outer coatings of two small jars, whilst sparks passed between knobs connected with the inner coatings. The bulbs glowed brightly at each discharge, rings of light being seen near their inner surfaces. On putting a ring tube outside the coil this was also seen to glow. The most brilliant part of the glow always occurred in close proximity to the wire coil. A secondary coil, wound by the side of the above-mentioned primary, could be short-circuited at will; this had the effect of decreasing or extinguishing the luminosity in the bulb or tube. Bright sparks passed between the secondary terminals when held a short distance apart, but the shock experienced by touching the ends was not serious. The above arrangement, with the addition of two Geissler tubes placed in series between the outer coatings of the jars, was used to illustrate the fact that closing the secondary diminishes the impedance of the primary circuit of a transformer. Experiments on condensers made of tin-foil on glass were shown. In one of them, parts of the coatings in the form of letters had been removed, and the spaces became luminous when the condenser was connected with an induction coil. In another experiment a glass plate was moved to and from a condenser, and a musical note could be heard whose pitch increased as the distance between the glass plates diminished. The note was said to be the octave of an open organ pipe, whose length was equal to the distance between the plates. Mr. Swinburne thought some of the effects shown were not Hertzian, but merely cases of ordinary mutual induction. He inquired whether the vacuum tubes would still glow if the Leyden jars were removed from the so-called resonating circuits. He was also of opinion that in the magnetic experiments the surfaces of the bulbs, and not the enclosed gases, took the charges. Mr. Watson asked if the authors had tried screening off the long waves by a wet cloth. If the effects still existed, this would prove that they were Hertzian. Mr. Blakesley wished to know if the images of the rotating tubes were at equal angular distances. Mr. Smith pointed out that these distances were not equal, but corresponded to equal changes of potential. Prof. Ayrton remarked that the only cases where the materials of the bulbs, tubes, &c., did not influence the results were those in which discharges were produced by varying magnetic fields. Mr. E. T. Carter thought an induction coil a more efficient machine for producing the glow in tubes than the alternator, &c., used by Mr. Tesla. Mr. Trotter asked if the authors had observed whether the glow produced by passing a discharge through a wire wound in a long pitch spiral round a tube formed an open or a closed circuit of light. Prof. S. P. Thompson said he first noticed that sparks passed between pieces of metal in the vicinity of an induction coil sparking into a condenser in 1876, when he was showing some experiments on telegraphic apparatus before the society, but unfortunately he did not pursue the subject. Long before Mr. Tesla's investigations Dr. Bottomley had shown that exhausted tubes could be caused to glow, but it was not until Tesla produced such phenomena on a large scale that people recognized how much light could be got in that way. Mr. Rimington, in replying to a question by Prof. Thompson, said the notes heard when the glass plate approached the condenser were of very high pitch. The explanation why in the experiments performed in varying magnetic fields, the bright parts of the luminous discharges were near the wire, appeared to be that the E.M.F. was greatest in these places. Although he had not tried the experiment, suggested by Mr. Swinburne, of taking off the Leyden jar, he felt sure that doing so would stop the glow.

Geological Society, November 23.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—Outline of the geological features of Arabia Petræa and Palestine, by Prof. Edward Hull, F.R.S. The region may be considered as physically divisible into five sections, viz. (1) The mountainous part of the Sinaitic Peninsula; (2) the table-land of Badiet-el-Tîh and Central Palestine; (3) the Jordan-Arabah valley; (4) the table-land of Edom, Moab, and the volcanic district of Jaulân and Haurân; and (5) the maritime plain bordering the Mediterranean. The most ancient rocks (of Archæan age) are found in the southern portion of the region; they consist of gneissose and schistose masses penetrated by numerous intrusive igneous rocks. They are succeeded by the lower carboniferous beds of the Sinaitic peninsula and Moabite table-land, consisting of bluish limestone with fossils, which have their counterparts chiefly in the carboniferous limestone of Belgium, and of a purple and reddish sandstone (called by the author "the desert sandstone," to distinguish it from the Nubian sandstone of Cretaceous age), lying below the limestone. The Nubian sandstone, separated from the carboniferous by an enormous hiatus in the succession of the formations, is probably of Neocomian or Cenomanian age, and is succeeded by white and grey marls, and limestones with flint, with fossils of Turonian and Senonian ages. The Middle Eocene (Nummulitic limestone) beds appear to follow on those of Cretaceous age without a discordance; but there is a real hiatus, notwithstanding the apparent conformity, as shown by the complete change of fauna. In Philistia a calcareous sandstone in which no fossils have been observed is referred to the Upper Eocene; for the Miocene period was a continental one, when faulting and flexuring was taking place, and the main physical features were developed—*e.g.* the formation of the Jordan-Arabah depression is referable to this period. In Pliocene times a general depression of land took place to about 200–300 feet below the present sea-level, and littoral deposits were formed on the coasts and in the valleys. To this period belong the higher terraces of the Jordan-Arabah valley. The Pliocene deposits consist of shelly gravels. Later terraces were formed at the epoch of the glaciation of the Lebanon mountains, when the rainfall was excessive in Palestine and Arabia. The volcanoes of the Jaulân, Haurân, and Arabian desert are considered to have been in active operation during the Miocene, Pliocene, and Pluvial periods; but the date of their final extinction has not been satisfactorily determined. After the reading of this paper the president remarked on the interest of the geology of an area, which was that of the Bible. Many authors had recorded their observations on this district, one of the latest being the author of this paper. Some years ago Mr. Holland had read a paper before the Society, and he (the speaker) believed that that writer was actually the first to prove the existence of carboniferous fossils in the Sinaitic peninsula. He remarked that *Lepidodendron mosaicum*, described by Salter, was somewhere preserved in the Society's museum, so that the Society had long ago had evidence of carboniferous rocks. Mr. Bauerman's paper, which was a reconnaissance in a comparatively unknown district, created great interest; and when that paper was read doubt was expressed as to whether the fossils then exhibited were carboniferous or triassic. After the researches of Prof. Hull there was no doubt that carboniferous rocks do occur in the region. As regards the granitic rocks (extending far up the Nile valley, in the Sinaitic peninsula, and elsewhere), they were all of much the same character, and, according to Sir William Dawson, occurred at two horizons—the lower rocks being granitoid and gneissic, the upper more or less volcanic, but still pre-carboniferous. He asked the author whether the Poudingues de Jebel Haroûn of Lartet were or were not ancient volcanic rocks. The Nubian sandstone of older writers included many things, but the age of the various sandstones was now satisfactorily determined by the author. Some were carboniferous, others (in the speaker's opinion) cenomanian. The calcareous formations of Judæa were well known from the writings of Lartet, Fraas, and others; but the exact line of demarcation between the Nummulitic limestone and the true Cretaceous had never been determined. It was a curious fact, as stated by Von Zittel, that not one fossil was common to the two deposits, which were nevertheless quite conformable. Miocene beds appeared to be absent, for, as noted by Lartet and confirmed by the author, this was a period of movement, when the great valley and the great fault were initiated. He (the speaker) felt that there were many difficulties connected with the depression which had not yet been cleared up. Lartet, Hitchcock, and others had traced the general direction of the fault; but the author had determined its exact site at more than one point. The most interesting point in this connection was the question of the age of the 700-foot saddle separating the Akabah watershed from the Jordan-Arabah depression. This saddle, in fact, separates the Jordan-Arabah depression from the Red Sea basin. Was it probable that this saddle was contemporaneous with the longitudinal fracture? Much depended on the determination of this question. Canon Tristram had shown that the fishes of the Jordan waters presented some curious analogies with the fish fauna of those of Africa, and Günther, after studying his specimens, had confirmed this view. He (the speaker) believed that this connection was not over the saddle of the Arabah, but might have been the 285-foot pass of the gorge of Jezreel. If the Pliocene depression, which the author thought was at least 200 feet, was a little greater, it would at least cause an outflow in this direction. As to the date of the basaltic eruptions, he thought the author's explanation was not unreasonable. He remarked that the Jordan-Arabah valley must have been of considerable antiquity, and had many lateral valleys of erosion more or less pointing towards the central hollow of the Dead Sea, whether from the Jordan or the Arabah end. Whither had the material thus eroded gone? It could not have passed over the saddle into the Red Sea, for the drainage had evidently been towards the Dead Sea for ages. He allowed that much was soluble limestone; but that must be precipitated somewhere, and the only conclusion he could come to was the somewhat heretical belief that the bottom of the Dead Sea had been an unsound one. Messrs. Irving, J. B. Lee, Topley, Hinde, and Whitaker also spoke. The author accounted for the change of species between the Cretaceous and Eocene limestones, as determined by Zittel, by supposing that at the close of the Cretaceous period the sea-bed had been elevated into a land-surface—but without flexuring—owing to which the life-forms of the Cretaceous ocean were destroyed, and upon resubmergence new forms entered from the outer ocean; in this way there would be no appreciable discordance of stratification, but complete change of species. As regards the origin of the saddle in the Arabah valley, he believed it was formed during the formation of the valley itself, not subsequently; the valley contracted very much at the saddle.—In reply to Mr. Topley's question, the author stated he had been informed that there was a very distinct terrace of gravel near the lake of Huleh, corresponding in level with that in the Arabah valley. About 1200 feet above the Dead Sea surface the intermediate representatives of this terrace may be found, but doubtless had been to a large extent swept away by floods and rains. In attempting to account for the difference between the faunas of the Red Sea and Mediterranean, it would be clear that once the isthmus of Suez had been converted into land, and the seas dissevered, differentiation would begin and proceed till all the forms unsuited to each had disappeared; difference in the temperature of the waters of the two seas would be the chief cause of differentiation.—The base of the Keuper formation in Devon, by the Rev. A. Irving.—The marls and clays of the Maltese Islands, by John H. Cooke.

Oxford.

University Junior Scientific Club, November 23.—The above club held its 124th meeting in the Physiological Laboratory, Dr. J. Lorrain Smith, President, in the chair.—Mr. E. M. Hamilton, Keble, brought before the club what proved to be a most interesting subject in his exhibit of "Flexible Sandstone," he pointed out that but little was known of the structure and consistence of this curious rock; it was found in India and was known by the name of Itacolumite. Mr. Hornby, Queen's, mentioned that he had investigated part of the specimen exhibited under the microscope after previous crushing; he held that the flexibility was due, not to mica, as was by some proposed, for in some specimens there was no mica, but rather to rough ball-and-socket joints between the grains; this idea was suggested by the irregular indentations observed in some granules and projections in others.—Prof. Green agreed with Mr. Hornby's theory as extremely probable; he gave an able *résumé* of the subject, and expressed his idea that there are more than one kind of rock roughly known as Itacolumite. He pointed out how the ball-and-socket arrangement might be produced, by the influence of pressure, in the presence of some dissolving agent, of which the power would be increased at any point of pressure, and so allow one granule to bore into another.—Mr. Sworn then gave a somewhat lengthy description of some results he had obtained with his rotatory hypsometer in actual use. When after the lapse of time, this subject was exhausted by Mr. Sworn, the club heard Mr. McDonald, Keble, who read a very able paper on the stereochemistry of nitrogen; the paper contained a review of all the latest work on this subject, and was amplified by models illustrative of the constitution of the various isomeric bodies mentioned.—During the meeting it was announced that Lord Kelvin had consented to deliver the "Robert Boyle" lecture in connection with this club, next summer term, the subject being "Magnetic Waves."

December 2.—Dr. J. Lorrain Smith, President, in the chair.—In the absence of Mr. Gunther, Magdalen, Mr. Hill, New College, gave his exhibit of a caterpillar which was found in Java. It was interesting on account of the curious flattened hairs with which it was provided, and has not yet been classified. After a short discussion the President read a paper on the thyroid gland, in which he described a series of experiments performed by him on cats as being the most suitable animal. He found that although the cats almost invariably died after removal of the thyroid gland, yet some lived a considerable time, and even improved in health and appearance. One cat in particular was even now in good health, although it was operated on in June of the present year. However, in this case a decrease of temperature brought on distressing symptoms such as convulsions. He further showed that though the respiration temperature and amount of the products of metabolism varied, the "quotient" remained constant. The animals thus, after removal of the gland, dying "quantitatively and not qualitatively." After a discussion, in which Dr. Turrell, Messrs. Pembery, Ramsden, Butler, and others took part, Mr. V. H. Veley read a paper on the necessity of water in chemical reactions. The author reviewed the works of Baker and others, illustrating his remarks by experiments. Then passing to his own research he showed that concentrated nitric acid did not react with dry sodium nitrite, and further that dry carbon dioxide and sulphurous oxide were not absorbed by dry calcium oxide. If absorption did take place, the amount was directly proportional to the quantity of water present.

Dublin.

Royal Dublin Society, November 16.—Prof. W. Noel Hartley, F.R.S., in the chair.—Prof. T. Johnson described an Irish alga—*Pogotrichum hibernicum*—new to science. He found it growing on *Alaria esculenta*, Grev., at Kilkee, co. Clare, in September, 1891. *P. hibernicum* differs from *P. filiforme*, Rke, in having unilocular and plurilocular sporangia in the same tuft, in having endophytic proliferous hyphæ, and in size. Comparison between *P. hibernicum* and *Litosiphon laminariæ*, Harv., of which herbarium material had been examined, was made. The paper was well illustrated by means of the Society's electric projector.—Mr. Alfred Harker then read a paper (communicated by Prof. W. J. Sollas, F.R.S.), on the use of the protractor in field-geology. Representing the inclination of a plane to a fixed plane as a vector of the type given by the gnomonic projection, the author deduces the laws of composition and resolution of such vectors, &c. Since the quantities can be laid down at once by a straight protractor, the common problems of field-geology and mining admit of ready graphical solutions.—Mr. John R. Wigham described a means of preventing the pollution of water of cities and other places where ball hydrants are used. He described the action of ball hydrants which, while making a perfectly tight and true joint while the pressure of water was in the mains, immediately fell from their seats when that pressure was removed for repairs, attachment of service pipes, &c., or reduced for any reason, and thus immediately admitted into the mains any liquid, whether pure or impure, which might be lying on the surface of the street or roads near the hydrant, and pointed out a simple remedy devised by Mr. Kelly, water inspector of Blackrock township. It consists of a spiral spring inserted beneath the ball of the hydrant, which assists the water to keep the ball in its place, and is at the same time strong enough to hold the ball firmly there when the pressure of water is removed. By the adoption of this spring, which is easily applied and inexpensive, costing only a few shillings, all danger of pollution from surface water is absolutely averted.—Mr. G. H. Carpenter submitted a supplementary report on the Pycnogonida collected by Prof. Haddon in Torres Straits, enumerating two additional species—*Pallenopsis Hoekii* (Miers), and *Rhopalorhynchus claripes*, sp. nov.—Sir Charles A. Cameron, M.D., communicated a paper on the action of phosphine on selenium di-oxide.

Paris.

Academy of Sciences, December 5.—M. d'Abbadie in the chair.—On an opinion brought forward at the British Association concerning sun-spots, by M. H. Faye. Regarding the suggestion that an electric discharge, in accelerating evaporation, might produce a lowering of temperature sufficient to cause the local decrease of brilliance known as a sun-spot, M. Faye points out the improbability of an electric discharge in a mobile medium lasting for a whole month, with the vapours constantly condensing on every portion of the sun's surface.—Chemical study of opium smoke, by M. Henri Moissan. Samples of the preparation of opium for smoking purposes, known as chandoo, were subjected to fractional distillation between the temperatures of 250° and 400°. At the former temperature a bluish smoke was given off, carrying with it certain agreeable perfumes and a small quantity of morphine. This ceased after a while, and the temperature had to be raised to 300°, when a more whitish smoke was liberated, which was less odorous and more acrid, and contained a small quantity of morphine, together with more or less poisonous bases. The latter reaction was also the only one obtained from the combustion of "dross" and adulterated opium, which give off poisonous compounds, such as pyrrol, acetone and hydropyridic bases.—Observations on the preceding communication, by M. Arm. Gautier.—On stereochemical notation, by M. C. Friedel (reply to the second note by M. Colson).—Calculation of continuous beams; a method in accordance with the new regulations of the ministerial order of August 29, 1891, by M. Bertrand de Fontviolant. This is a method of graphic statics applicable to all cases of moving loads, based upon the construction of the "lines of influences" of the bending moments, shearing stresses, reactions of supports, and elastic yieldings respectively. The problem is the following: Given two points in a plane, A and B, and a system of parallel continuous forces whose intensities are linear functions of the abscissæ of their points of application, to trace a funicular curve of these forces with polar distance equal to $\frac{1}{3}$ the projection of A B on a direction perpendicular to these forces.—Observations of Wolf's periodic comet, made with the great telescope of the Toulouse Observatory, by MM. E. Cosserat and F. Rossard.—Observations of Holmes's new comet, made at the Algiers Observatory, by MM. Rambaud and Sy.—Observations of Brooks's comet (discovered November 21, 1892), made at the Marseille Observatory, by M. Esmiol.—Observations of the same, made by M. Fabry (see Astronomical Column).—On infinite groups of transformations, by M. A. Tresse.—On an indeterminate problem of analysis connected with the study of hyperfuchsian functions resulting from hypergeometrical series with two variables, by M. Levavasseur.—On the fusion of carbonate of lime, by M. H. Le Chatelier.—Remark on a note by M. Barthe concerning the volumetric estimation of the alkaloids, by M. P. C. Plugge.—Physiological researches on opium smoke, by MM. N. Gréhant and Ern. Martin. Experiments performed upon a dog under conditions analogous to those observed by opium-smokers failed to produce any perceptible effect. One of the experimenters then smoked twenty pipes himself, the quantity of opium amounting to four grains. The experiment lasted for an hour. After the fourth pipe a frontal headache supervened, which became general after the sixth. At the tenth he felt giddiness, especially in walking; but these effects were not aggravated up to the close of the experiment, and had disappeared an hour afterwards. The respiration showed a lesser amplitude towards the end, the beating of the heart was slightly less frequent, and the curves of pulsation were more flattened at the summits.—On the measure of the permeability of soils and the determination of the number and the surface of the particles contained in 1 cc. of soil, by MM. F. Houdaille and L. Semichon.—On the exchanges of carbonic acid and oxygen between plants and the atmosphere, by M. Th. Schlœsing, jun.—The artificial production of rutile, by M. L. Michel. The following is a new process: Heat during several hours in a graphite crucible, at a temperature of about 1200°, an intimate mixture of 1 part titaniferous iron and $2\frac{1}{2}$ parts pyrites. On cooling, a crystalline mass is found, which breaks easily, and exhibits all the physical and chemical characteristics of pyrrhotine. This mass is riddled with small holes, to the walls of which are attached crystals, which possess the composition and the crystallographic and optical properties of rutile. They can be easily separated by means of hydrochloric acid.—On a new ellipsometer, by M. Jannettaz.—On the existence of inversion phenomena in the neighbourhood of Gréoulx (Basses-Alpes), and on the age of these dislocations, by M. W. Kilian.

BERLIN.

Physical Society, November 4.—Prof. du Bois Reymond, President, in the chair.—Dr. du Bois described and explained the phenomena he had observed during the passage of polarized light through gratings, and dealt with the polarizing effects of the latter. He also discussed the relation of the phenomena to those described by Guy, as accompanying the deflection of light at metallic edges, and to those observed by Hertz during the polarization of long electric waves by wire gratings. Dr. Gross made a further statement on entropy, criticizing Clausius's proofs and advancing a general theorem from which the principle of entropy can be deduced. His views were opposed by Prof. Planck. Prof. Erdmann exhibited excrescences 3 c.m. in length attached to an aluminum penholder which had lain in contact with mercury; they consisted of hydrate of alumina.

Note.—In the report of the meeting of October 21 (NATURE, vol. xlvii. p. 24), column one, last line, for "lime-spectrum" read "line-spectrum," and in last line of column two, for "amalgams" read "alloys."

Meteorological Society, November 8.—Prof. von Bezold, President, in the chair.—Dr. Lachmann spoke on temperature. extremes in the United States (North America), based on the recently published results of observations extending over twenty years.

BOOKS, PAMPHLET, and SERIALS RECEIVED.

BOOKS.—Child-Life Almanac, 1893 (Philip).—An Elementary Text-Book of Physiology: J. M'Gregor-Robertson, 2nd edition (Blackie).—Reformed Logic: D. B. McLachlan (Sonnenschein).—The Naturalist on the River Amazons: H. W. Bates; with a Memoir of the Author, by E. Clodd (Murray).—Elements of Agriculture: Dr. W. Fream, 4th edition (Murray).—Our Earth—Night to Twilight: G. Ferguson (Unwin).—Report on the Meteorology of India in 1890: J. Eliot (Calcutta)—Carl Wilhelm Scheele, Nachgelassene Briefe und Aufzeichnungen: A. E. Nordenskiöld (Stockholm, Norstedt).

PAMPHLET.—Columbus and his Discovery of America: H. B. Adams and H. Wood (Baltimore).

SERIALS.—Journal of the Marine Biological Association, new series, vol. ii., No. 4 (Dulau).—Engineering Magazine, December (New York).—Himmel und Erde, December (Berlin. Paetel).—Journal of the Straits Branch of the Royal Asiatic Society, December 1891 (Singapore).—Actes de la Société scientifique du Chili, tome ii, 1ère livraison (Santiago).

CONTENTS.

PAGE
Criticism of the Royal Society 145
The Elements of Physiology. By L. E. S. 146
Applied Mechanics. By G. A. B. 147

Our Book Shelf:—

Wright: "Man and the Glacial Period" 148
Kapple and Kirby: "Beetles, Butterflies, Moths, and other Insects" 148
"Ostwald's Klassiker der Exakten Wissenschaften" . 149

Letters to the Editor:—

"Aminol, a True Disinfectant."—**Dr. E. Klein, F.R.S.** 149
"Tracery Imitation."—**Prof. J. Mark Baldwin** . . 149
Difficulties of Pliocene Geology. By **Sir Henry H. Howorth** 150
Meteors.—**Prof. C. A. Young** 150
Comparative Sunshine.—**Bishop Reginald Courtenay** 150
Quaternions. By **Alex. McAulay** 151
Animals' Rights.—**The Reviewer** 151
The Height and Spectrum of Auroras.—**T. W. Backhouse** 151
The Teaching of Botany.—**A. H.** 151
Egyptian Figs.—**Rev. George Henslow** 152
A Palæozoic Ice-Age.—**Dr. W. T. Blanford, F.R.S.** 152
Scheele. By Prof. T. E. Thorpe, F.R.S. 152
Werner von Siemens. (*Illustrated.*) **By E. F. B.** . 153
Notes 155

Our Astronomical Column:—

Comet Holmes (November 6, 1892) 159
Comet Brooks (November 20, 1892) 159
The New Brooks' Comet 159
Nova Aurigæ 159
Astronomy at Columbia College, U.S.A. 159
Companion to the Observatory for 1893 159
Geographical Notes 159
The Destruction of Immature Fish 160
The New Telephotographic Lens. By W. 161
Arborescent Frost Patterns. (*Illustrated.*) **By G. J. Symons, F.R.S.; Rev. T. G. Bonney, F.R.S.; Dr. J. H. Gladstone, F.R.S.; D. Wetterhan; J. T. Richards; J. J. Armitage** 162
The Making of Rifles 163
University and Educational Intelligence 163
Societies and Academies 164
Books, Pamphlet, and Serials Received 168